AE

THE ENGINEERING IN AGRICULTURE NEWSLETTER

SPRING 1997

Manure Application to Forages

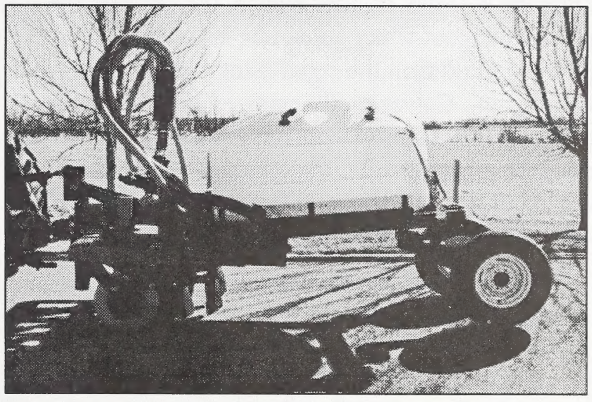
Blaine Metzger, Project Technologist, AFMRC, Lethbridge

In the Spring of 1996, the Alberta Farm Machinery Research Centre (AFMRC), in cooperation with the County of Lethbridge, began a 4-year research project applying manure to an irrigated alfalfa forage crop. Their goal is to find out how much liquid or solid manure can be applied without damaging the forage crop, or contaminating the soil and existing waterways. These results will help farmers evaluate the best application methods, timing of application, and the effect of manure type and rate for distributing their manure resource.

The traditional means of manure application has been on cultivated land used to grow cereal and oilseed crops. Results of this experiment may allow for increased land bases for application of manure resources.

The experiment involved applying solid cow and liquid pig manure on forage land. During the spring and fall, four replications at rates of 0, 60, 120, 180 and 240 lbs/ac were applied. Solid manure was broadcasted while the liquid manure was injected with a coulter assembly. Manure and soil samples were analysed for nutrient content. The forage was harvested at two maturity stages. Forage samples were weighed for yields, adjusted for moisture, and analysed for protein. After one season, no significant differences in any of the results were noted.

In 1997, this project will be expanded to one or two more sites near Airdrie. The added sites are on tame hay and/or pasture seeded areas. Cooperators for the new sites are Alberta Agriculture, Food and Rural Development (AAFRD), the Municipal District of Rocky View, and the Foothills Forage Association.



Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT
Engineering Services

Printed on Recycled Paper

The purpose of this newsletter is to advise of activities and projects being conducted by Alberta Agriculture, Food and Rural Development's Engineering Services and Regional Agricultural Engineering staff. For further information on these projects and other engineering related activities contact:

Lethbridge	381-5112	Airdrie	948-8525
Red Deer	340-5322	Vermilion	853-8224
Barrhead	674-8256	Fairview	835-2291
Edmonton (Eng. Services)	427-2181	Lethbridge (AFMRC)	329-1212

Published by Engineering Services, Rural Development Division, Alberta Agriculture, Food and Rural Development

Pasture Water Quality and Cattle Performance

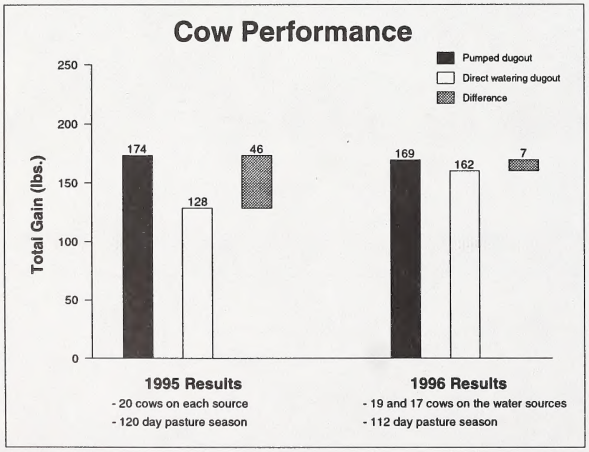
Bob Buchanan, Agricultural Engineering Technologist, Barrhead

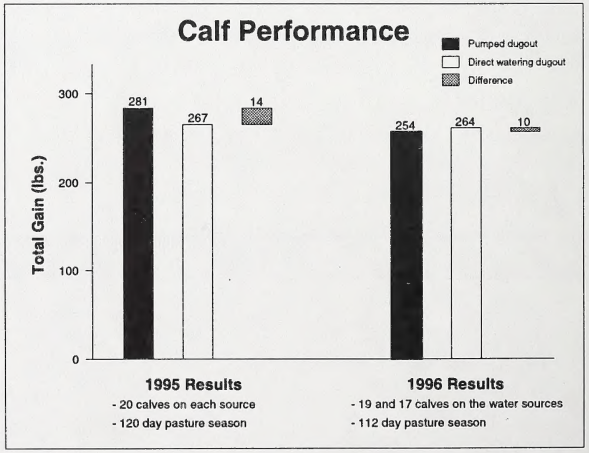
Most pasture studies done across Western Canada have shown that watering cattle directly from farm dugouts reduces their performance. Several studies have shown weight gains of up to 25 percent higher when cattle were supplied good quality water rather than watering directly from a dugout. Other studies have shown that parasitic loading, including giardia cysts, can significantly reduce cattle performance.

In 1995, CAESA (Canada/Alberta Environmentally Sustainable Agriculture Agreement) funded a project at Stony Creek Farm to assess the impact pasture dugout and water quality has on cattle performance. Forty cow/calf pairs were divided into two groups and the pasture was fenced off into two sections. One group drank directly from a dugout on one section of the pasture while the second group drank water from a stock tank pumped from a fenced dugout on the other portion. During the summer, dugout water samples were taken and tested for giardia, cryptospiridium, faecal coliform bacteria and chemicals. The dugouts were regularly observed for algae and weed growth. Over the 120-day pasture season, the cows on the pumped dugout water gained 21 kilograms (46 pounds) more than the cows using the direct watering dugout. Calves on the pumped dugout source gained 6 kilograms (14 pounds) more. Although the research team agreed that pumping water from a fenced dugout made a significant improvement in cow and calf weight gains, the difference is unclear.

In 1996, the project was expanded with funds from the On-Farm Demonstration Program to try to answer some questions from the 1995 results. Along with monitoring, done the previous year, the following tests were done to the cows: mid summer weighing, ultrasonic backfat measurements, parasite examinations of the cow manure, water and grass (grass conditions were also assessed). The cows were also pregnancy tested to prove weight gains better. Results from 1996 were dramatically different with only a 3-kilogram (7.3 pounds) gain by cows and a 5-kilogram (10.3 pounds) loss by calves on the pumped dugout side of the pasture. In spite of many negative factors (ie, according to our analysis), including poorer grass conditions, cow conditioning, higher initial parasitic loading, the cows on the pumped dugout side of the pasture still gained a small amount of weight.

Project team members believe that if grass conditions had been identical on both sides of the pasture, the cows and calves would have gained more weight than their counterparts on the direct dugout watering side. The question is why? Are the differences in the cows and calves parasitic loading, water access or water quality? Although the data is not conclusive, our research team is convinced that better water quality, because of pumping from the dugout, is an important factor in increasing cattle performance on pastures.





Designing Farm Buildings for Snow

Dennis Darby, Structures Engineer, Lethbridge

The design of buildings for roof snow loads is one of the most important requirements of a building plan. The *National Farm Building Code* (FBC) is the reference on snow loads that most builders and truss manufacturers follow. Though farm buildings are not governed by the *Alberta Building Code*, in a dispute, the courts will look unfavourably on cases where this standard is not followed.

Roof failures can usually be traced to one of four causes:

- There was an unusual amount of snow, often accompanied by drifting to one side of the roof.
- The roof or its supports were not adequately designed.
- Web bracing, critical to the strength of roof trusses, was left out by the builder.
- Corrosion or decay weakened the trusses.

The 1990 FBC introduced the major change, *"that roofs of farm buildings must be designed for the same snow loading conditions as other buildings in the Building Code."* The three most serious snow conditions are:

(1) unbalanced or drifted loads on one side of a gable roof,

(2) increased snow loads in valleys, and

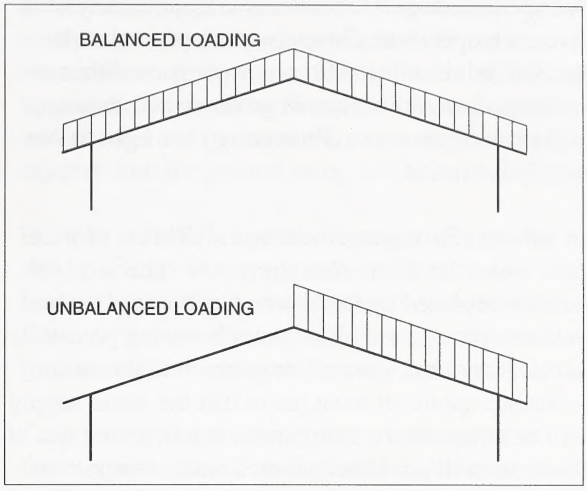
(3) heavy snow on lower roofs attached to a main building.

The codes also allow reduced roof snow loads for *"locations exposed to wind,"* where wind is likely to to remove snow from the roof. Two problems arise:

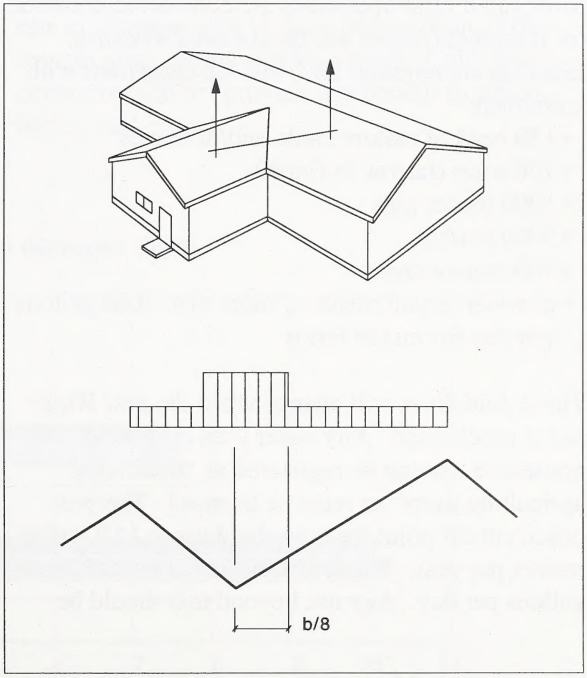
(1) that same wind also causes excessive snow drifts on some shapes of roofs, and

(2) conditions change over the years, so a building may not be exposed to wind after the shelter belts grow or new buildings are added.

For more information on building design, refer to the new technical bulletin *"Snow Loads for Farm Buildings."*



Balanced and unbalanced loads on gable roofs steeper than 3/12



Increased snow loads in valleys

Water Licensing for Well Water

Ken Williamson, Agricultural Engineering Technologist, Red Deer

An adequate supply of water is critical for any livestock operation. Groundwater is a renewable, but limited resource. If more water is used than is recharged, water levels will go down and someone will be without water. Protecting your right to this supply is crucial.

In Alberta, the management and allocation of water falls under the *Water Resources Act*. This *Act* will soon be replaced by the *Water Act*, but this has not yet been proclaimed. The water licensing process is administered by Alberta Environmental Protection. A license applicant must prove that the water supply will be adequate for their needs, and that their use of the water will not have an unreasonable impact on other water users.

What farm operation needs a license?

Most small farm operations are considered domestic (or household) users and do not need a license. Licenses are required for livestock operations with more then:

- 150 head of mature cattle and/or horses
- 100 sows (farrow to finish)
- 1000 feeder pigs
- 5000 poultry
- 200 mature sheep
- or water requirements of more than 3000 gallons per day for mixed farms

These guidelines will change when the new *Water Act* is proclaimed. Any water uses exceeding household use can be registered as "traditional agriculture users" or must be licensed. The proposed cut off point for household use is 1250 cubic metres per year. This averages out to about 750 gallons per day. Any use beyond this should be registered or licensed. "Traditional agriculture users" can register an additional 6250 cubic metres per year for their existing operations. This registration process is not yet in place.

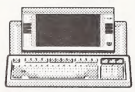
Licensing water for older existing farm operations

If a farm has been operating for many years, has higher livestock numbers than those listed above, had a well drilled before September 1993, and the water supply has not been a problem, a license can often be processed without major cost or effort. It is just a matter of documenting the past and present water use and applying for the license.

Licensing water for new and expanding operations.

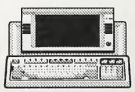
The applicant must prove there is sufficient water to meet his requirements and not affect neighbouring water users. An exploration permit must be applied for first. If the permit is granted, the well can be drilled and tested. A hydrogeological consultant must be hired to analyse the data, assess any impact on neighbouring water users, and prepare a report that meets the requirements of Alberta Environmental Protection. The consultant's report will cost between $3,000 and $6,000 to prepare.

Once the license is issued, it puts your name on the amount of water licensed. Only household users, or holders of older licenses, will have a higher priority. New, competing water users must prove that their water use will not interfere with your supply. Licenses are processed by Alberta Environmental Protection Regional Offices in Red Deer, Edmonton, Leduc, Peace River, Calgary and Lethbridge.



We're on-line! Visit us at:

www.agric.gov.ab.ca/esb/index.html



Anhydrous Ammonia Cold Flow Converters

Robert Maze, Project Engineer, AFMRC, Lethbridge

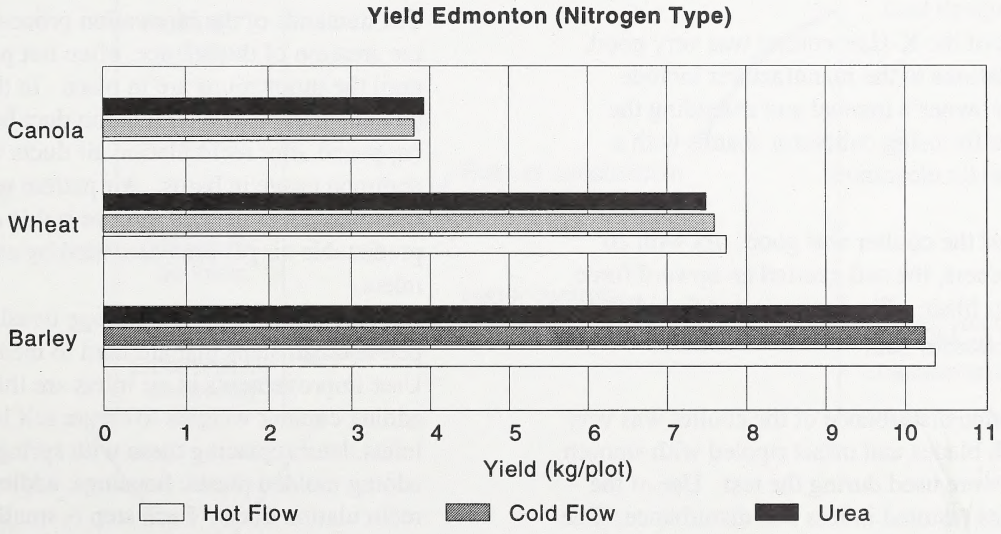
The popularity of anhydrous ammonia (NH_3) as a nitrogen source for crop production continues to grow. Research into the safe use of NH_3 while seeding, along with the typically lower cost and higher concentration of nitrogen, have helped its use grow across the prairies. However, the use of NH_3 is not without its controversies. One of the long running debates among farmers has been whether cold liquid or hot vapour flow of NH_3 is better in terms of the soil's ability to retain the nitrogen.

NH_3 consists of 82 percent nitrogen and 18 percent hydrogen by weight. It occurs as a vapour and turns into a liquid at -33 C (-28 F). For use in agriculture, NH_3 is maintained in a liquid form under pressure in a nurse tank. As it is released from the tank into the distribution system of the fertilizer application, the NH_3 expands and begins to warm, converting into hot flow vapour.

To turn the vapour form of NH_3 back into liquid before it is put into the soil, cold flow converters are used. NH_3 expands in the convertor and freezes, separating the liquid ammonia from the vapour and greatly dropping the pressure. Only about 85 percent of the anhydrous ammonia turns liquid, the remainder stays in vapour form. The liquid flows by gravity, through regular application equipment, into the soil and the remaining vapour is normally injected into the ground using additional hose.

In 1996, AFMRC, Agrium, Bourgault Industries and Prairie Seeds completed a study at sites in Lethbridge and Edmonton to decide whether cold flow convertors offered any advantages over hot flow in respect to crop emergence and final yields.

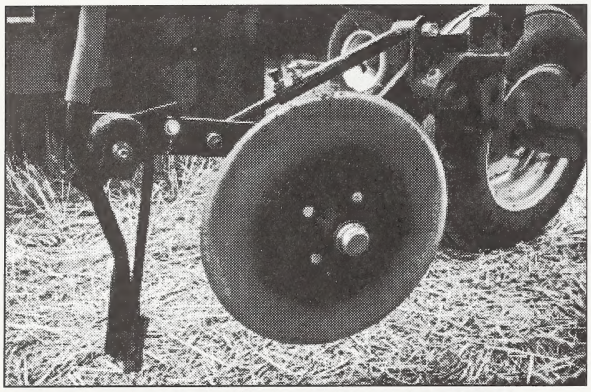
Crop emergence and yield were measured after direct seeding wheat, barley and canola using four seeding systems and three nitrogen fertilizer rates. Nitrogen was applied as cold flow liquid anhydrous ammonia, hot flow vapour anhydrous ammonia, and as granular urea. The trials showed the type and rate of nitrogen used in the study made no difference in plant counts and final yield. Cold flow convertors did not provide any benefit to wheat, barley, and canola.



Evaluation on Coulter Completed

Lawrence Papworth, Project Engineer, AFMRC, Lethbridge

The Alberta Farm Machinery Research Centre (AFMRC) has completed an evaluation of the K-Hart Coulter. Popular for residue cutting prior to seed openers and fertilizer application, it is the only coulter manufactured in Canada.



The coulters were mounted and tested on the AFMRC mini air seeder using a row spacing of 20 in. (508 mm). John Deere cultivator shanks equipped with McKay spoon openers were used for seeding. The coulters were used to apply granular urea and anhydrous ammonia.

Performance of the K-Hart coulter was very good. Recommendations to the manufacturer include supplying an owner's manual and extending the coulter shank for using cultivator shanks with a large frame to tip clearances.

Penetration of the coulter was good. As with all disk type openers, the soil exerted an upward force on the coulter blade. The force ranged from 85 to 200 lbs (378 to 890 N).

Soil and residue disturbance of the coulter was very low. Smooth blades and offset rippled with smooth edge blades were used during the test. Use of the smooth blades resulted in less soil disturbance. The blades cut through residue in firm soil and dry residue. Shallow depths, soft moist soil and damp residue conditions caused residue hairpinning.

The power required to operate each K-Hart coulter at 5 mi/h (8 km/h) varied from 1.2 to 2.7 PTO hp (0.9 to 2 PTO kW). Maximum tractor size needed to operate each coulter was 3.1 PTO hp (2.3 PTO kW). An evaluation report will be released shortly.

Understanding How Technology Develops

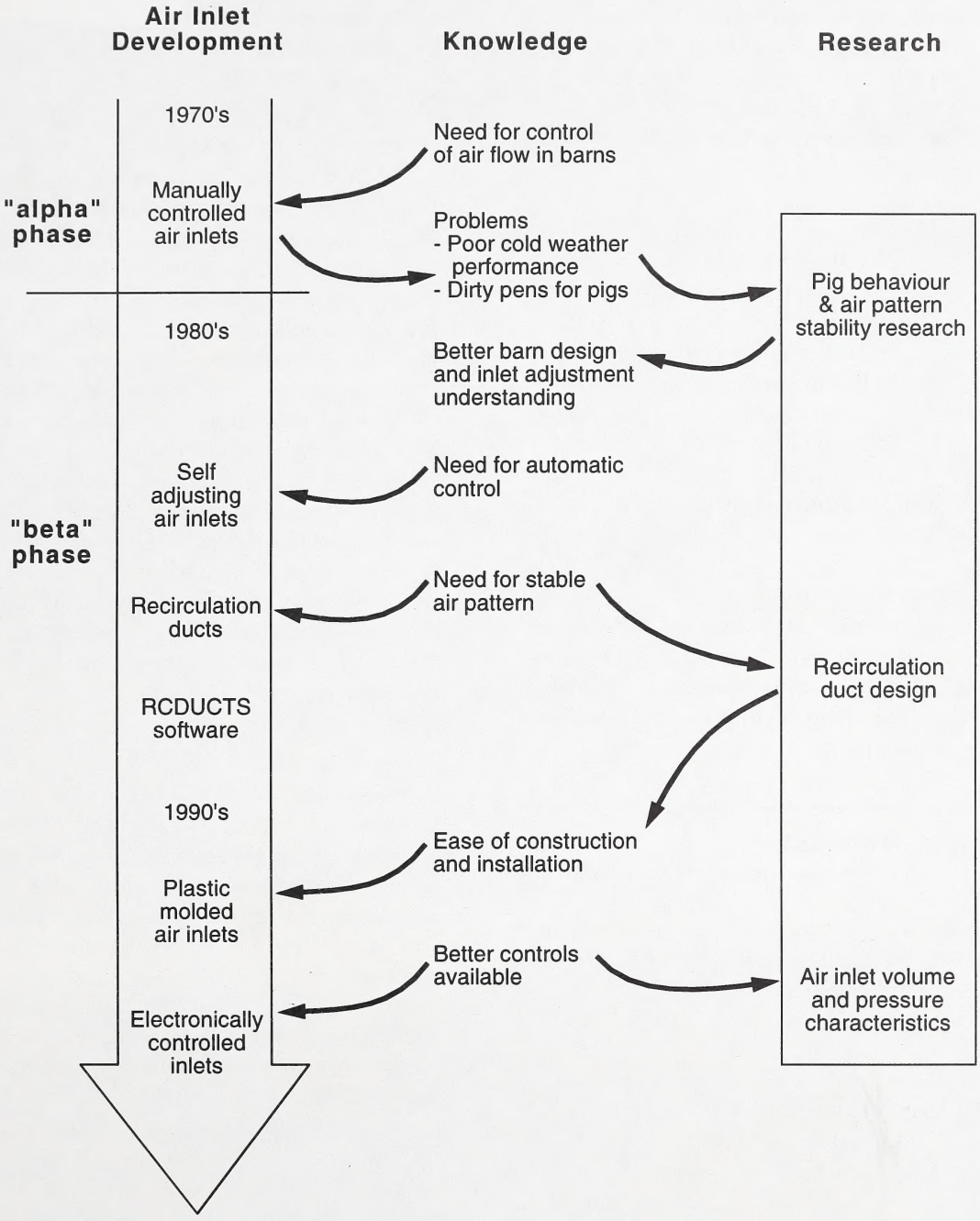
Robert Borg, Agricultural Engineer, Red Deer

Agriculture is an industry where technology is continuously developing and improving. Several students of the history of technology have described the innovation process as central to the creation of science. Typically, an innovation has an "alpha" phase where it is first introduced. Later, there is a "beta" phase where the users of the innovation keep improving and developing the technology. The cost benefits of the beta phase usually far exceed the value of the alpha phase of development. The development of the innovation adds to the accumulated knowledge base in the industry and allows for further improvements. It is also, as shown in the example, central to scientific development.

The flow chart on the opposite page shows some interesting points:

- The demands of the innovation process drive the creation of the science, often not possible until the innovations are in place. In the example, the science of recirculation duct behaviour happened after recirculation air ducts were in common usage in barns. Air pattern research was driven by the need to have stable and predictable air patterns delivered by existing air inlets.
- Developments in the technology usually happen in small steps that are hard to measure. User improvements in air inlets are things like adding counter weights to create self balancing inlets, later replacing these with springs, then adding molded plastic housings, adding recirculation ducts. Each step is small but the accumulated benefit is much larger than the initial value of the original innovation.

Air Inlet Development Technology



Alternative to Wheel Packer

Lawrence Papworth, Project Engineer, AFMRC, Lethbridge

One project completed last winter in the Alberta Soil Bin Test Facility was the development of the Burr packing system. This system was designed to replace the use of a wheel packer. Walter Schoenhofer, a farmer from Wetaskiwin, contracted AFMRC to help him develop and evaluate the system. Results were promising, as the Burr packing system effectively packed the seed under most Soil Bin conditions.

The Burr packing system mounts behind a narrow knife opener. This system consists of two metal plates, mounted behind the knife, and a burr placed below the plates. The burr acts as a trowel and packs the soil. A spring mounted rod applies pressure to the burr, allowing the burr assembly to trip. A fertilizer tube can be mounted behind the burr to apply any fertilizer not placed with the seed. To incorporate fertilizer, roughen the surface and break up lumps of soil, a chain can also be mounted behind the burr.

Additional power required to pull the Burr packing system varied from 0.7 to 1.2 hp (0.5 to 0.9 kW) per opener. The power required to pull the knife opener would be added to the above to arrive at the total power. Field testing on the Burr packing system is planned for this spring.

A Whole New Look!

Joanna Fyck, Architectural Engineering Technologist, Edmonton

After almost a year of organizing and reorganizing, the Engineering Services Branch Home Page is finally online. It is designed for Netscape 2.0 or later and is set up in a "frames" format. We have tried to make it clear and as user-friendly as possible to enable our readers to navigate through our files. For those of you who have later versions of Netscape, or non-frames capable browsers, there is an alternate site available to you.

We have catalogued our information into eight main categories:

- About Engineering
- Crops
- Livestock
- Farm Machinery
- Structures
- Soil & Water
- Energy/Power/Processing
- Newsletters/Publications

An index appears under each of the above categories to help you navigate to a more specific topic area. "About Engineering" will give you some background about the Engineering Services Branch and introduce you to our engineering teams. A staff listing is also included, with E-mail links to put you into direct contact with our specialists. You will also find a "Comments/Suggestions" link under each category to give us some feedback on our site. We would like to know what you want to know in order to serve our readers better. Another feature listed under specific topics is "Ask an Engineer". Depending on which category you are in, a prescreened list has been developed to enable the user to contact the specialist for that specific topic without having to page through our staff listing. All of our latest newsletters are listed under "Project News", also available under each category. These consist of articles outlining our latest research projects and studies.

A brand new feature located under the "Farm Machinery" category is the "Alberta Farm Machinery Research Centre Home Page". It contains all the inside information you need on services offered and available at the Centre. All the Evaluation Report summaries are online, as well as numerous research study reports.

So take the time to check out our "New Look" Home Page and let us know what you think. Our new address is:

www.agric.gov.ab.ca/esb/index.html

We welcome all your comments and suggestions.